CHANGING WHAT'S POSSIBLE

Nuclear Product Detection From Deuterated Nanoparticles Under Phonon Stimulation

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Public Release Slide

Project Title:

Nuclear Product Detection From Deuterated Nanoparticles Under Phonon Stimulation

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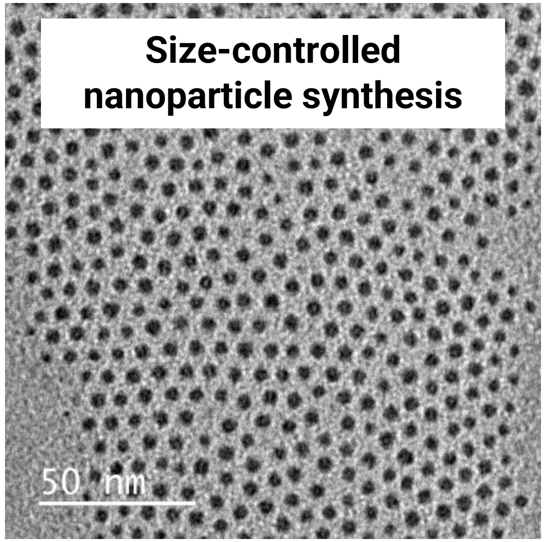
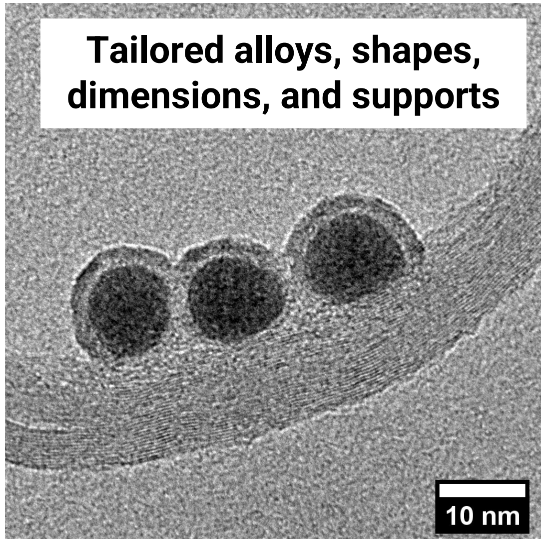
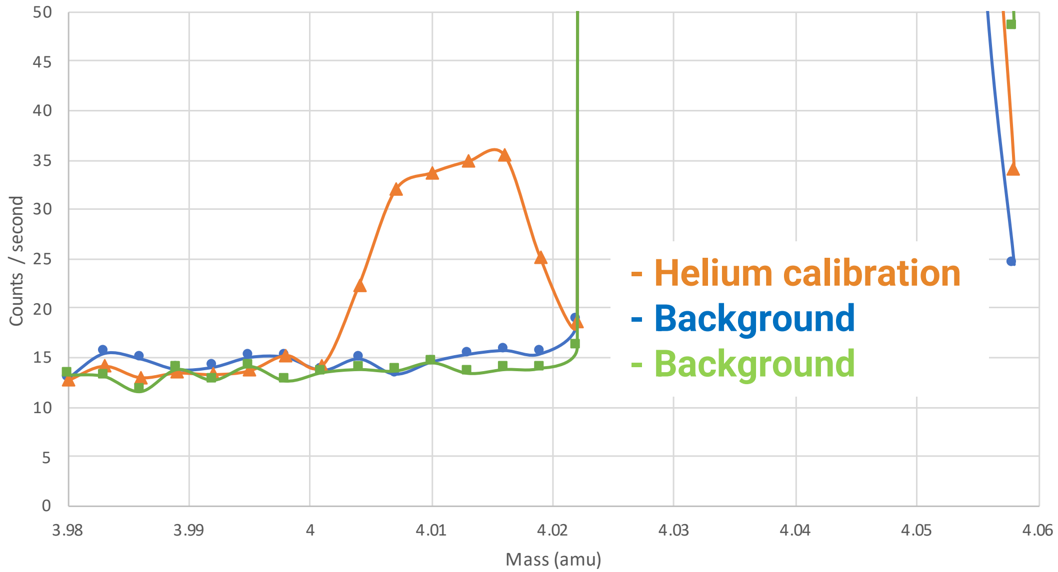
Project Outcomes:

Demonstrate real-time production of helium and MeV charged particles from deuterated metallic nanoparticle alloys under resonant stimulation





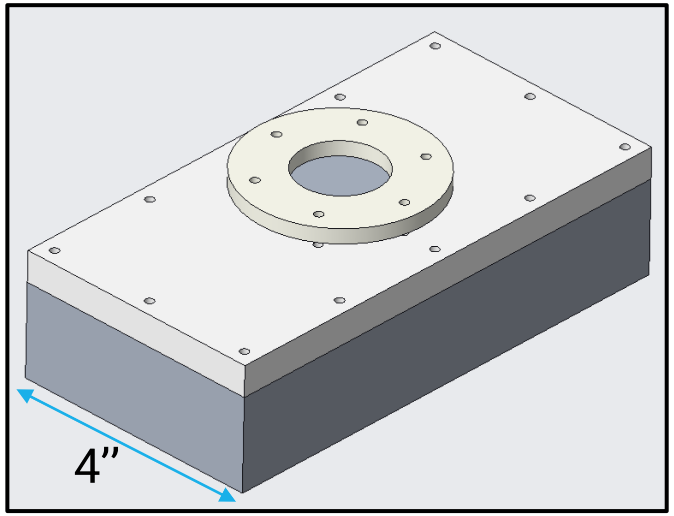


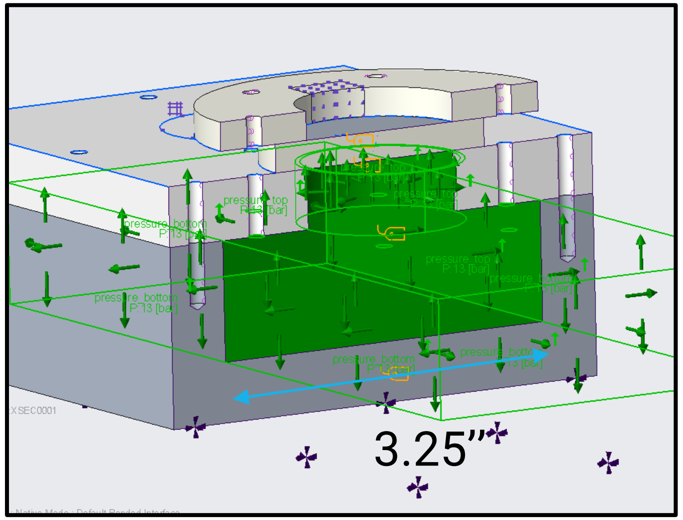
Hypothesis

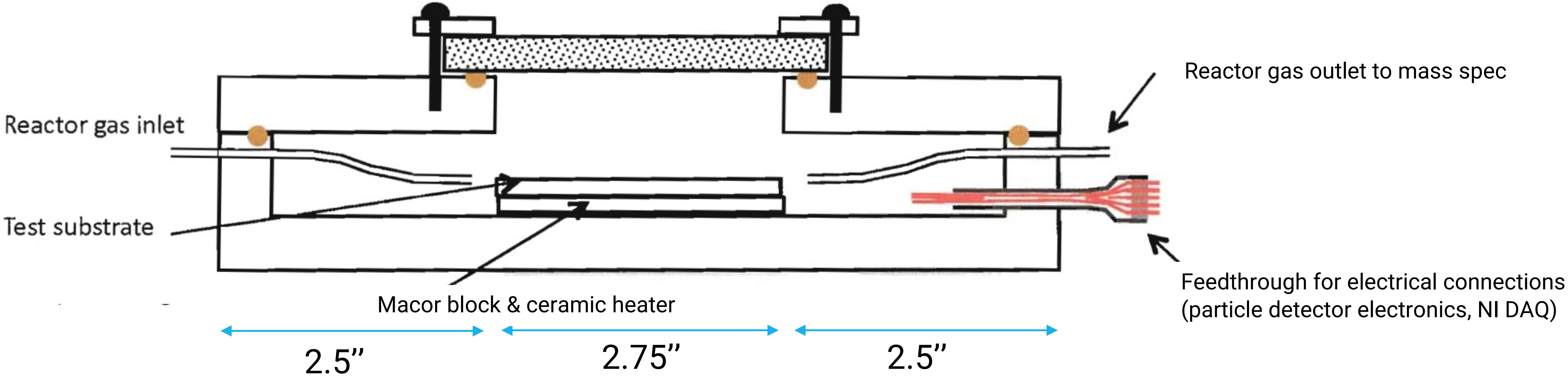
- Statement of hypothesis
  - deuterated metallic nanoparticles become LENR-active by (1) creating active sites with small D-D separation, (2) exciting coherent vibrations, and (3) facilitating an energy transfer pathway that produces helium-4 and MeV-scale charged particles at reaction rates significantly amplified above of a bare D2 molecule.
- Summary of pre, active, and post measurements
  - Pre/Post TEM analysis of catalyst
  - Independent Variables:
    - diode irradiation frequency: 800-1000nm (targeting 2–30 THz beat mixing)
    - substrate temperature: 0-500C (RTDs)
    - reactor pressure: 1-20 bar, with pressure transducers
    - catalyst composition: particle shape/dimensions & support (TEM), alloy/dopant ratios (EDX)
  - Dependent Variables:
    - helium concentration: sub-100 ppb (high-res mass spec)
    - charged particle counts: micro-Watt flux (particle detector)
    - catalyst temperature: 0.01C (RTDs)

Experimental Setup – Reactor Cell

- Stainless steel 304 reactor; KBr window
- Macor block holds ceramic heater & substrate
- Cell volume 300cc; reduced for faster mass spec signal response
- Deuterium (99.999% purity)
  - isotopic enrichment 99.8
  - H2 < 100, HD < 3000 ppmv

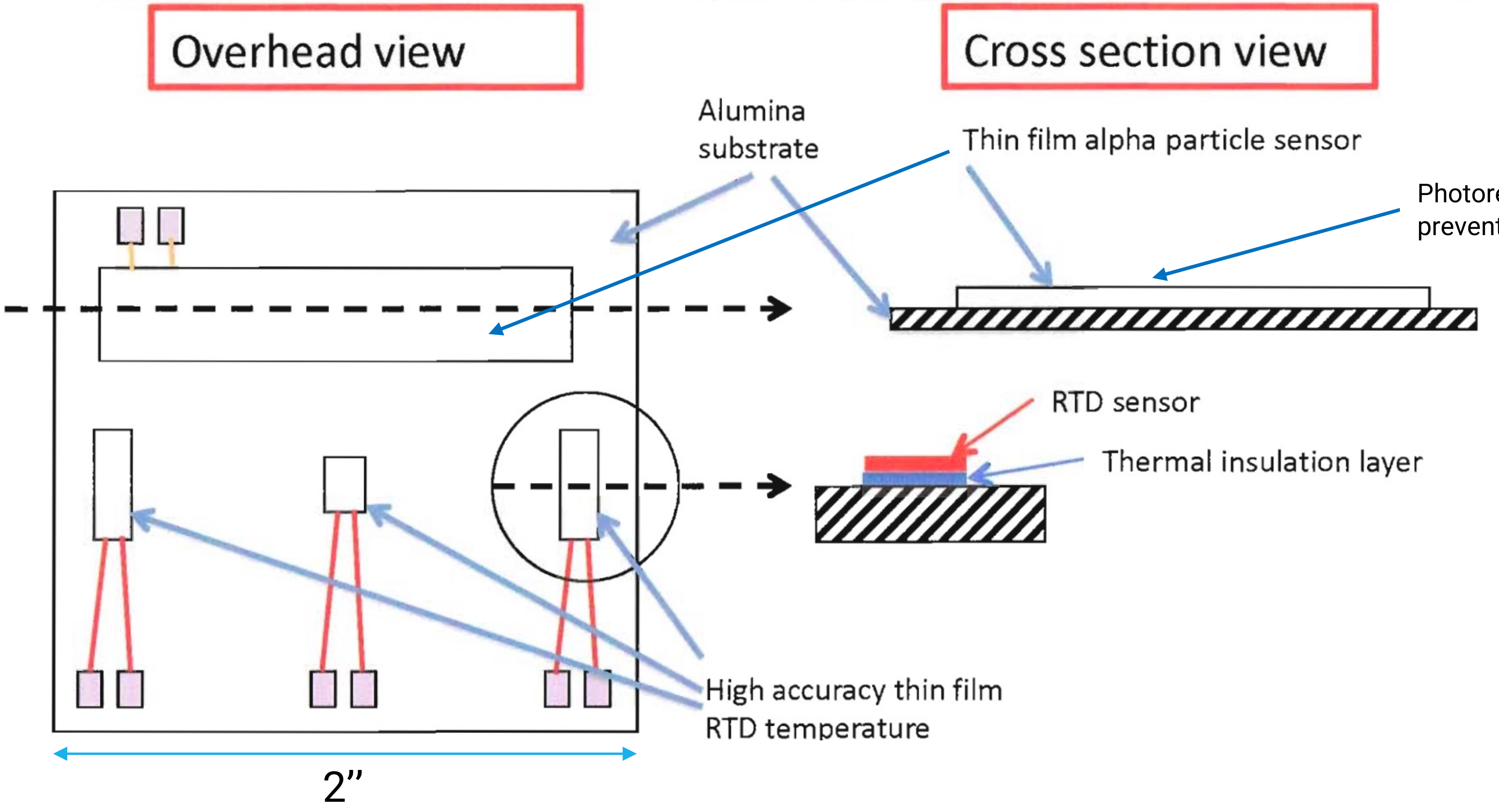






Experimental Setup – Catalyst substrate

- Alumina substrate holds catalyst layer
- SiC charged particle detector to catalyst ~5 micron photoresist



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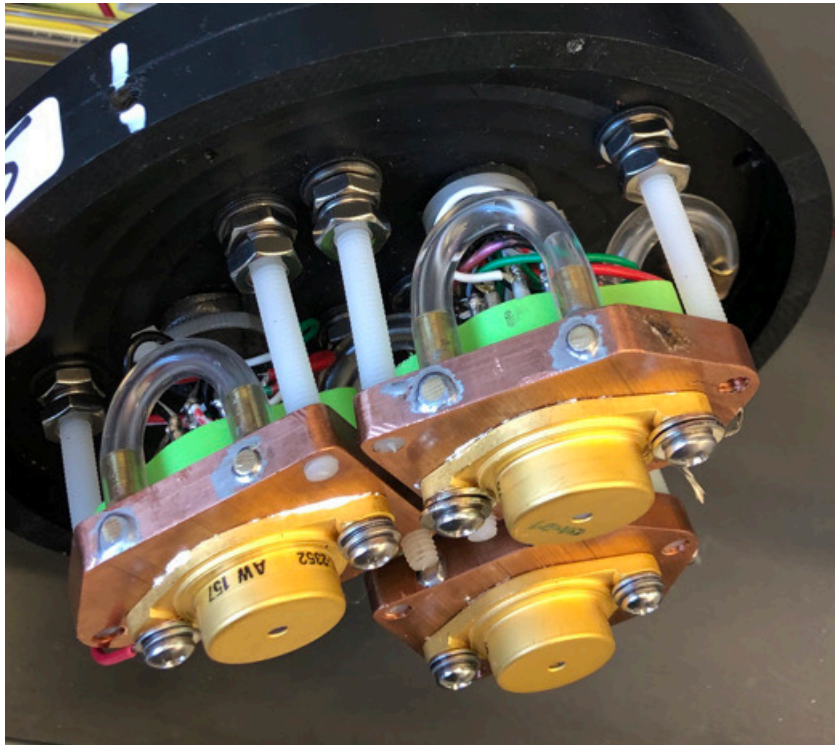
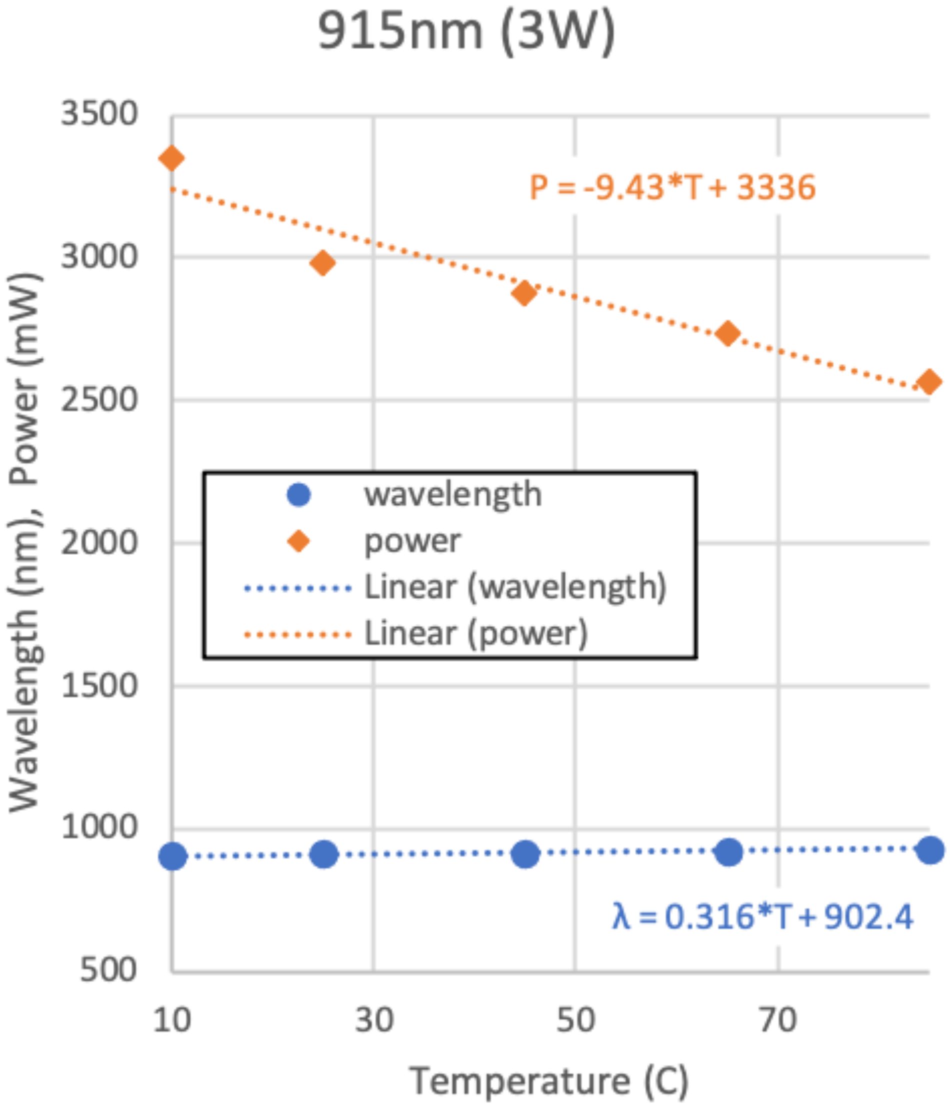
Experimental Setup – Solid state diodes

- IR diodes 800-1000nm (RPMC) with 1-6 Watt output
- Separated by 4”–8” from catalyst surface
- Frequency-tuned by Arroyo TECSource power supply

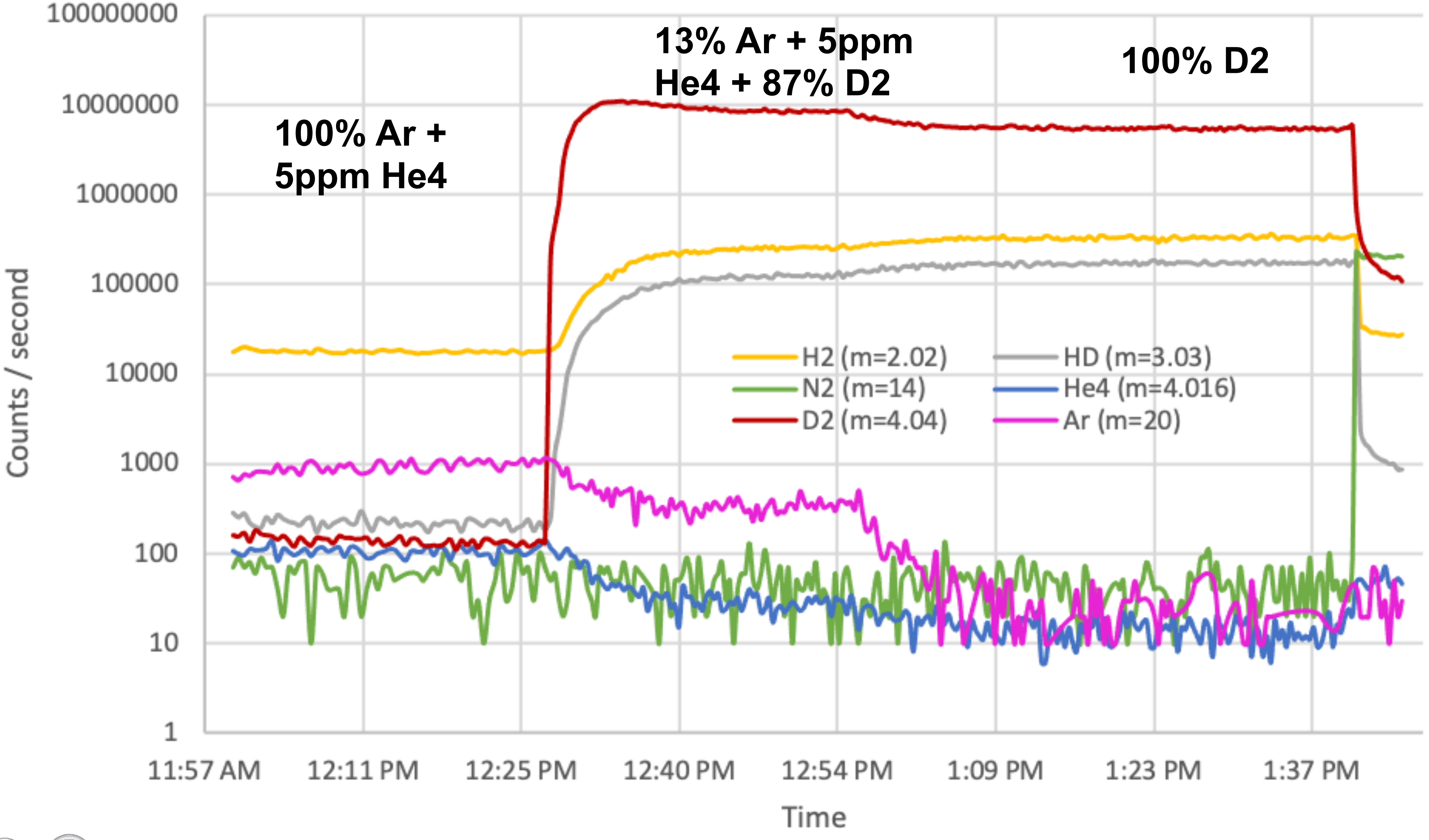




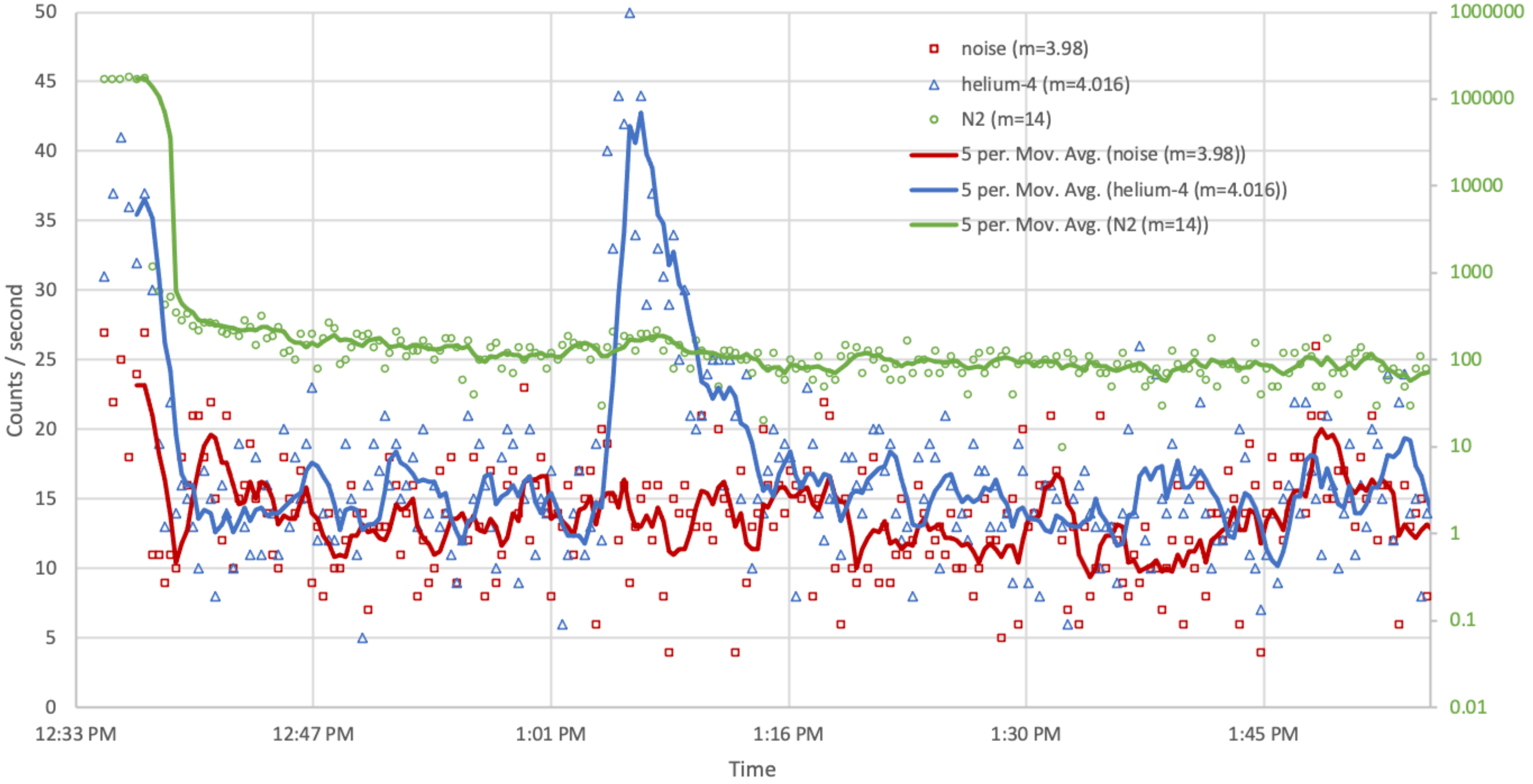
Data Acquisition

Measurement	Recording Method	Settings	Latency	Storage Media
Helium, Nitrogen, Neon/Argon	Hiden DLS-20 quadrupole mass spec	events, counts/sec (bkgd 15 c/s)	10-30 sec	Hiden MasSoft
Temperature (catalyst, substrate)	RTDs (resistance)	0–500C	< 1 ms	National Instruments DAQ & Labview
Pressure	Pressure transducer (voltage)	1–20 bar	< 1 ms	National Instruments DAQ & Labview
Charged Particle Counts & Energy	Ortec pre-amp & radiation detector bias supply (current, voltage)	events, counts/sec	< 1 ms	National Instruments DAQ & Labview

Data Acquisition – Mass spectrometer (no catalyst)



Data Acquisition – Mass spectrometer (helium calibration)



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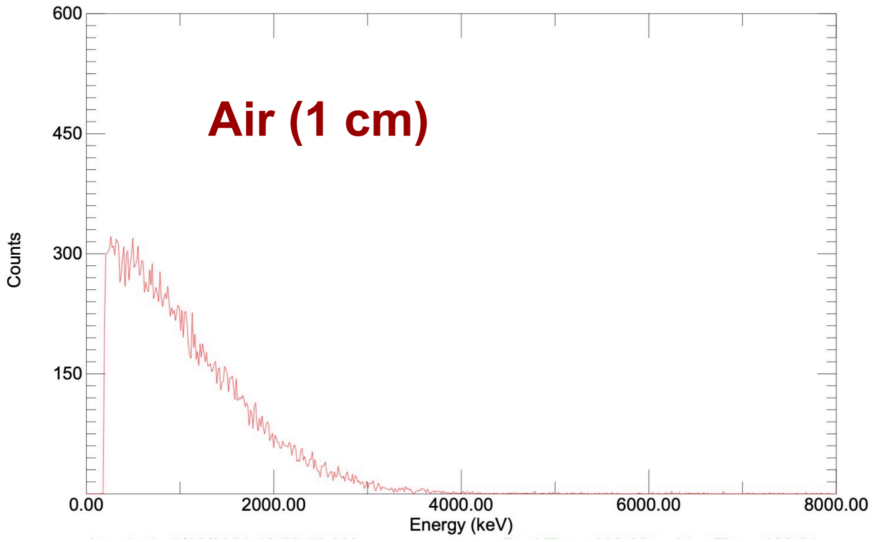
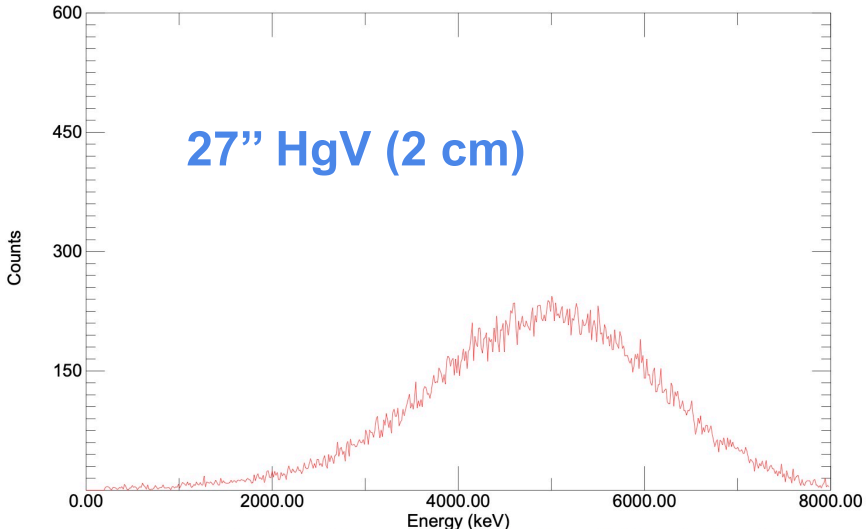
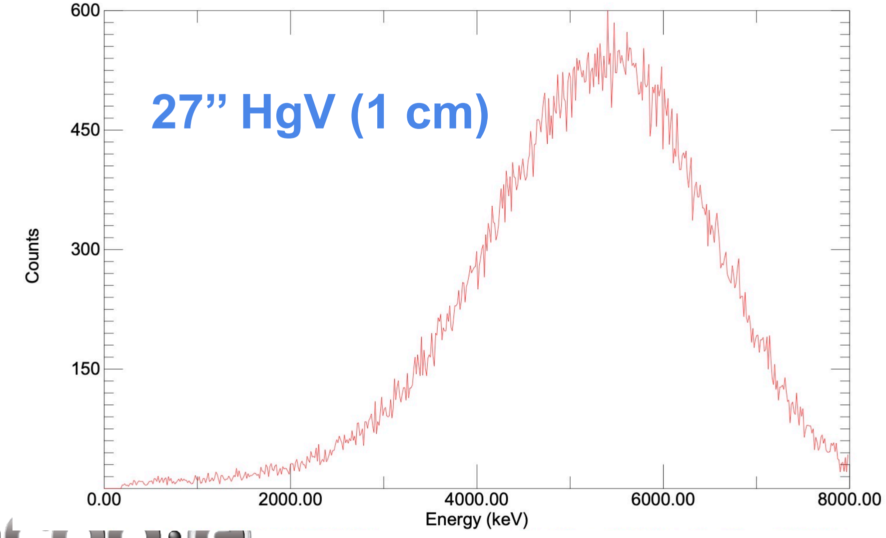
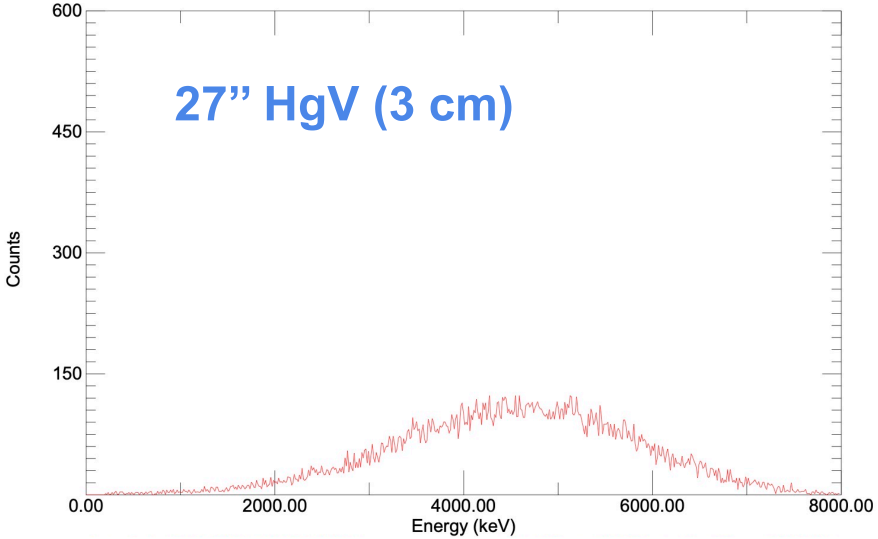
Data Acquisition – Si detector counts & energy for calibration (Am241)



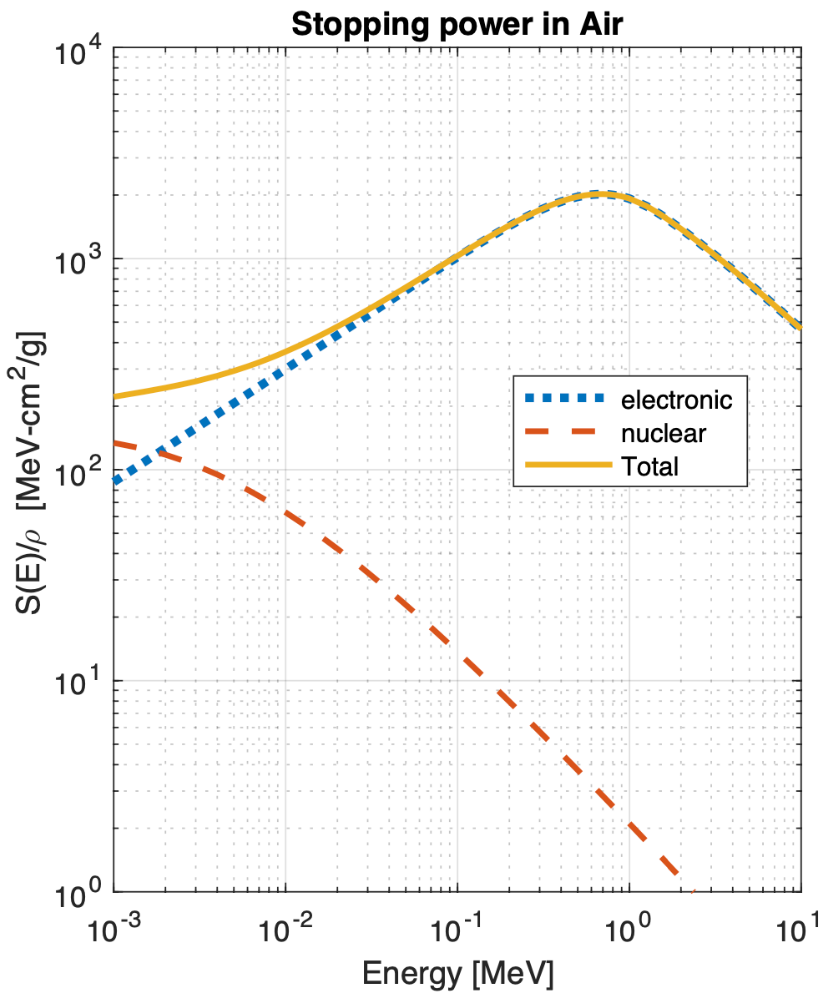


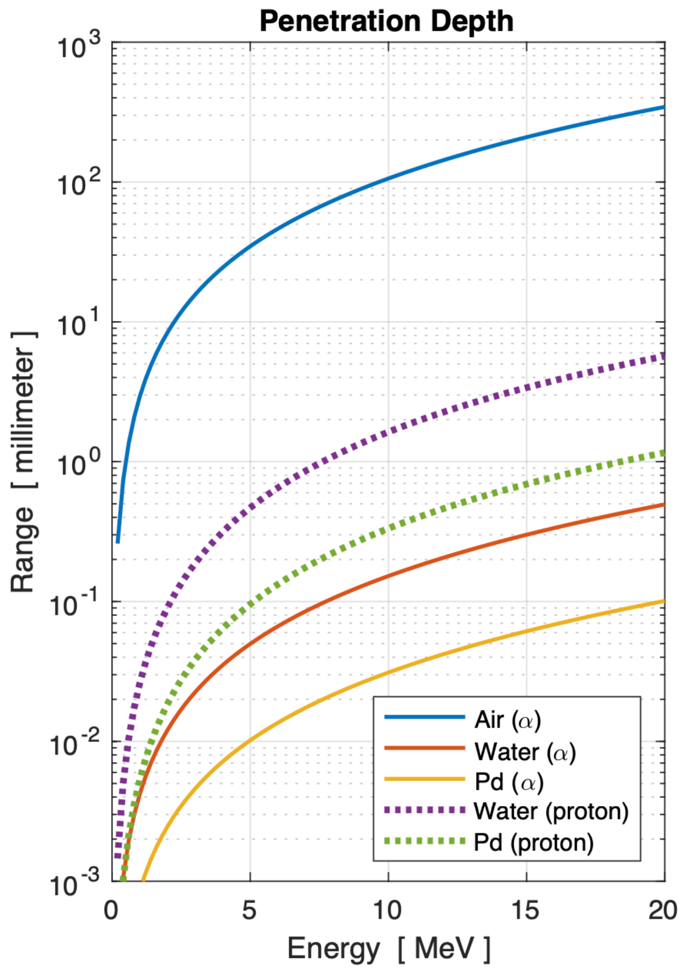




Modeling

- Alpha particle penetration calculation through SiC depletion layer
- Possible DFT & band structure calculations for phonon spectra





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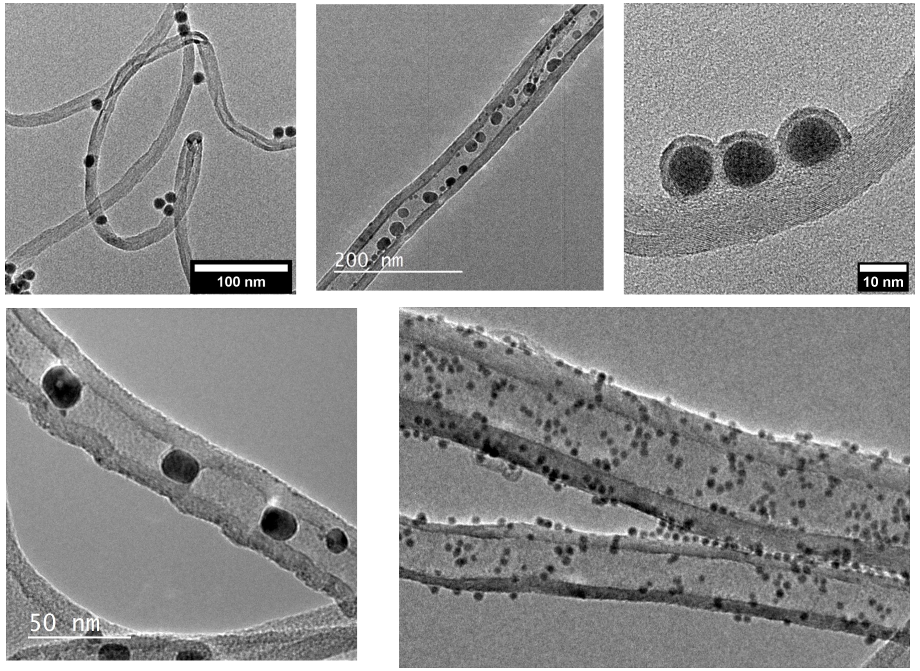
Initial Test Plan

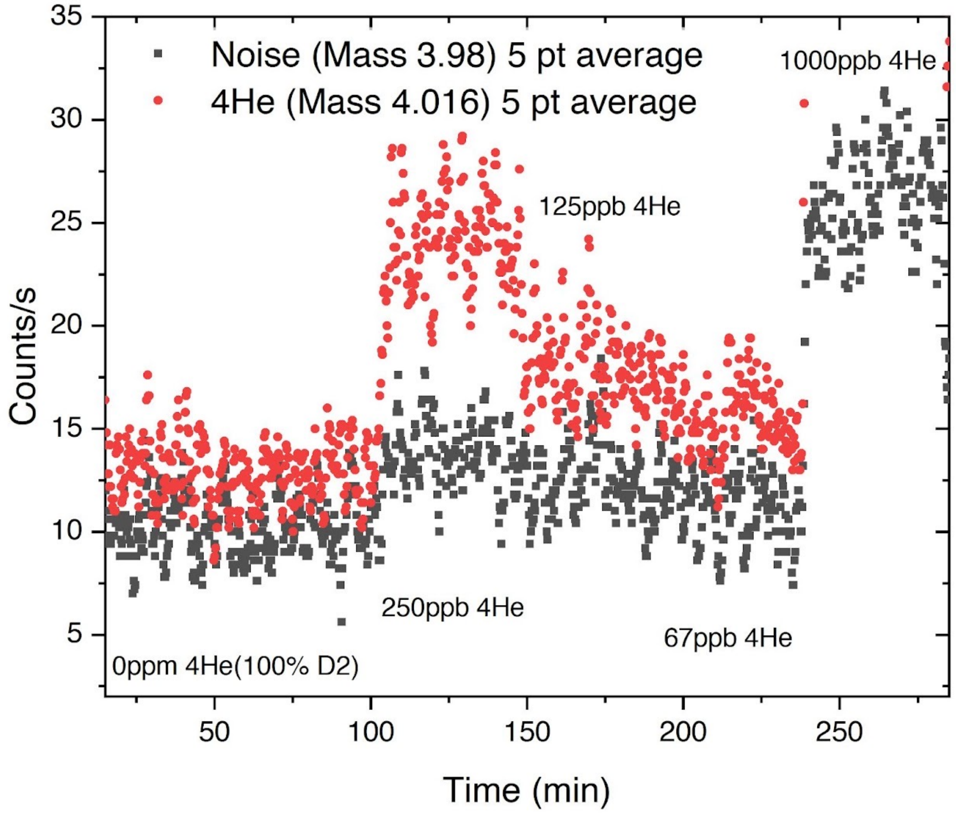
- **Synthesis**: grow colloidal Pd-nanomaterials on stable supports
  - Carbon nanotube and ceramic supports for high thermal stability
  - Alloy particles to enhance non-linear optical response
- **Laser Stimulation**: Verify diode output at target frequency & THz mixing response
- **Particle Detector**: Work with UMich, TTU (Cat. B) teams for detector fabrication

Initial Results

- Developed Initial Catalyst Library
  - Nanoparticles on CNT supports
  - Alloy combinations, Pd-Ni
  - Size 2-20nm, core-shell



- Demonstrated helium sensitivity
  - Calibration pulse with air injection
  - Two modes of operation: real-time "flow" runs & sustained "batch" runs



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Plans for Next Quarter (Oct-Dec)

- Synthesize target nanoparticle material with reproducible recipe
  - Characterize with TEM, elemental analysis, chemisorption
  - Demonstrate target alloy/dopant concentrations
- Demonstrate tunable beat frequencies across 2–30 THz range
  - Explore nano-engineered approaches to maximizing laser mixing on catalyst (*e.g.* nanoparticle composition, dimensions, shape)
- Begin evaluation of SiC charged particle detector
  - Collect I-V curves demonstrating Schottky diode response
  - Record alpha counts & energy with source in reactor cell
- Demonstrate helium calibration sensitivity
  - Explore improvements, *e.g.* getter materials
  - Work with TTU team to test secondary validation